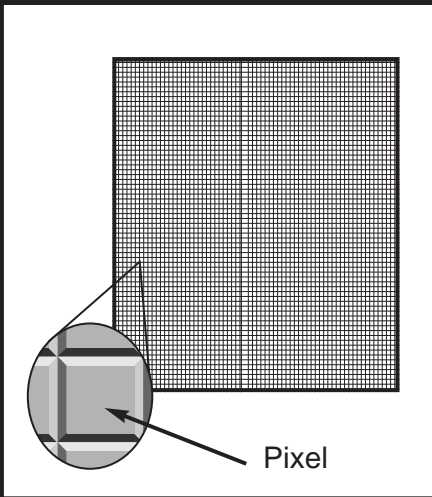


CCD Imaging

CCDs (Charge-Coupled Devices) are detectors sensitive to light. CCD chips are made of semi-conducting materials such as silicon, manufactured to be sensitive to the impact of light hitting their surfaces. When light, consisting of discrete photons, hits the detector surface of the CCD microchip electrons are given off and stored in the detector elements, or pixels. (See diagram.)

A CCD microchip contains thousands of pixels. When a CCD camera is pointed at a bright area of the sky, a large number of photons hit the chip. More photons generate a larger number of electrons. Thus, a brighter portion of an image has a greater number of electrons stored in each pixel than a darker area.

Graphical representation of a CCD microchip.



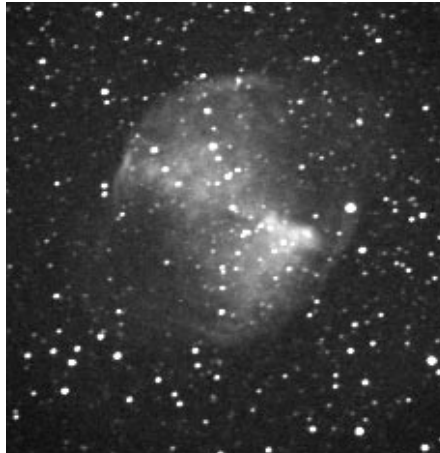
Converts light to numbers

The process of CCD imaging converts an image (e.g. the image of a galaxy) into a series of discrete digits

Once an image is digitised it is processed by the computing software. Even quite poor digitised images of celestial objects that are hardly recognisable can be processed into magnificent, beautiful images. Digital image processing enables the extraction of a weak signal from a large amount of noise.

More light-sensitive than film

CCD chips have greatly increased light-sensitivity compared to film so exposure times are typically much



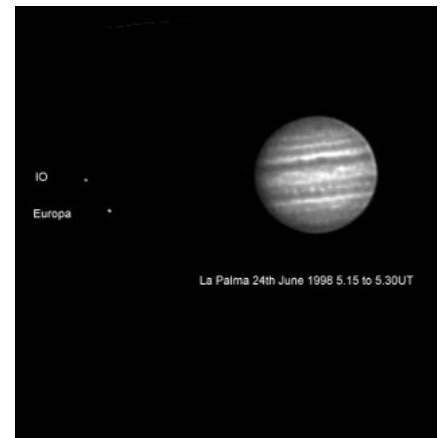
M27 Dumbbell Nebula
by Adrian Catteral

shorter, and post-exposure image processing provides an amazing level of image enhancement.

The CCD imager attaches to the telescope's eyepiece-holder in a similar manner to a conventional camera body. The imager allows a very fast "picture" (digital exposure) to be taken of even faint celestial objects. This exposure can be seen immediately on the display screen of a standard personal computer or laptop and, if desired, can be stored on a disk for future reference or printed out to obtain a hard copy of the image.

Factors to be considered when choosing a CCD camera include:

- the physical dimensions -the larger the chip, the more sky area that can be imaged at one time.
- the pixel sizes -smaller, more tightly-packed pixels result in higher image resolution.
- the pixels' well capacity -the total number of electrons that can be stored in each pixel before it becomes saturated.
- fill factor -the percentage of the chip's area that is sensitive to light, and
- quantum efficiency -the sensitivity level of the chip to light.



Jupiter and satellites
by Rob Dalby and Nik Szymancek

